CHAPTER 7

Rangelands

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❄ CRITICAL FINDINGS

Historic Grazing Impacts Historic unregulated grazing, which ended in the early 1900s, created widespread, profound, and, in some places, irreversible ecological impacts. Foothill habitats have suffered physical and biological damage of many riparian systems and virtual replacement of the native perennial flora by Eurasian annuals.

Current Grazing Effects Current livestock grazing practices continue to exert reduced but significant impacts on the biodiversity and ecological processes of many middle- to high-elevation rangelands even though properly managed grazing (appropriate timing, intensity, duration of use, control of cowbirds, and exclusion from wetlands) can be compatible with sustainable ecological functions.

Restoration of Upland Rangelands Increases in native perennial grasses are occurring on some east-side sagebrush-steppe rangelands, but the continuing cheatgrass invasion of these habitats indicates that complete restoration of native plant communities is highly unlikely.

Restoration of Meadows and Riparian Systems Easily damaged by improper grazing, montane meadows and riparian systems are resilient relative to restoration of plant cover, but restoration of stream channel shape, system function, and biodiversity may take decades.

Conversion of Hardwood Rangelands Human settlement patterns represent the largest threat to continued sustainability of ecological functions on hardwood rangelands.

Oak Woodland Resiliency Oak woodlands (particularly blue oak) are much more stable than previously thought; concerns about regeneration are not well founded.

ASSESSMENT

Historic Rangeland Ecosystems

Poorly managed or unmanaged livestock use of Sierra Nevada rangelands, especially during the late 1800s, contributed to reduced productivity and impaired health of these ecosystems. Continuing problems in some riparian areas and the persistent dominance of exotic annual grasses in foothill and east-side rangelands, with the accompanying decline in potential productivity of these sites, warrants an examination of historical causes and possible remedies for these problems.

Historical accounts of rangeland condition and use in the late 1800s indicate that highly productive rangeland communities existed throughout the study area when Europeans arrived. Large elk herds were present on the west side of the range. Native perennial grasses were dominant in the grassland communities, although exotic annuals had begun their invasion even before the arrival of the first missions in 1769, evidently resulting from the travels of early Spanish explorers throughout the Southwest more than two hundred years earlier.

During the late Pleistocene (before 10,000 years ago), a grass-sagebrush rangeland existed where montane and subalpine forests occur today, while at lower elevations conifers occurred. The sagebrush grasslands supported a diverse ecosystem of now extinct megafauna, including a large number of herbivores and a formidable group of mammalian predators. The disturbance regime associated with these herbivores, quite unlike livestock disturbance under traditional livestock management, would have presumably provided several crucial functions for sustaining the high productivity of rangeland ecosystems, including the breakdown of dead plant material and the recycling of nutrients, while allowing seed germination and seedling establishment. These landscape-level energy and nutrient transfers increased energy flows and perennial plant cover, thereby increasing the net productivity of rangeland vegetation, improving the rangeland water cycle, and increasing water capture by plants. The synergistic nature of the relationship between Pleistocene herbivores and rangeland productivity, although not known for certain, is supported by recent research with alternative livestock management practices that have substituted high-intensity, short-duration grazing for the traditional low-level, chronic grazing disturbance. Also unknown is whether or not the Sierra Nevada grassland ecosystems encountered by Euro-Americans were disturbance adapted, as might have been the case prior to the extinction of the Pleistocene megafauna.

Effects of Early Use of Rangelands

The first extensive use of Sierra Nevada rangelands for livestock began in the 1860s. A number of observers reported severe and repeated overstocking until about 1900, due in part to a lack of regulation of the common rangelands. The combination of poor grazing practices and extended periods of drought contributed to the conversion of Sierra foothills from perennial to annual grasslands and is also implicated in the expansion of juniper woodlands on the east side of the range.

Without regulation of access during the late 1800s, overutilization of the common rangelands of the Sierra Nevada occurred. With unregulated use of this common-pool resource by many livestock operators, no user had incentive to reduce usage or conserve resources, because any benefit so conserved was quickly captured by other users. As a result,

A stream channel damaged by cattle grazing. Plumas National Forest, Milford Ranger District, Doyle Allotment. (Photo by John W. Menke.)

A healthy meadow on the Tahoe National Forest that was subjected to moderate levels of cattle grazing and then allowed to rest for five years. (Photo by John W. Menke.)

Sierra Nevada rangelands were overgrazed, in that native forage plants did not have enough time to recover after severe, repeated grazing. As unregulated grazing was eliminated, recovery of some of the rangeland vegetation in many areas was fairly rapid, at least in terms of forage production.

Fire has perhaps had the largest effect on Sierra Nevada rangeland. From 1880 to 1910 sheepherders set large fires every fall as they left the public lands. These fires opened vast areas of western montane slopes and foothill chaparral shrubland areas to livestock grazing and left large areas subject to erosion. Where there was regrowth of nutritious forbs and shrubs, deer numbers increased dramatically. In contrast, fire-suppression policy since that time has generally allowed decadent habitat conditions to develop except where wildfire or vegetation management programs have restored some of the natural role fire has in these ecosystems.

Until the Taylor Grazing Act of 1934, little attention was given to livestock grazing capacity limits. During World Wars I and II, increased livestock use occurred again on public rangelands, often without regard to appropriate stocking rates. It is clearly apparent from well-documented Forest Service allotment reports that managers recognized that grazing problems were occurring. Given the emphasis at the time, managers believed that transient cattle and sheep use and range depletion were jeopardizing the local livestock economy. From the 1950s through the early 1970s, stocking rates on many allotments were reduced to levels closer to sustainable grazing capacity but still above that threshold and without adequate safeguards for riparian habitats. Range improvement activities common during this period included water developments, range seedings, brush control, and other practices that attempted to restore former grazing capacities.

Sierra Nevada and Modoc Plateau rangelands are susceptible to exotic annual grass and forb invasion following depletion of native perennial grasses. Overgrazing can also influence soil compaction, erosion, and lowering of water tables. Reducing perennial grasses allows for increased water availability in soil, which then promotes continued invasion by exotic annual plants, sagebrush, and juniper. For the same reason, yellow star thistle, an exotic annual forb, has spread and is altering native biodiversity and ecological functions of Sierra Nevada foothill annual grassland and oak woodlands. When short-season annual grasses and forbs replace perennial grasses, forage productivity and carrying capacity are reduced for livestock and wildlife.

In the 1970s, stream riparian wildlife and fisheries habitat concerns began to surface, and public land-management agencies developed various riparian initiatives. Following numerous demonstration projects, interdisciplinary research projects, symposia, and workshops, major new management actions began. Widespread adoption of practices is slow in coming, but riparian-sensitive management has continued to increase over the last twenty-five years. Today it is a prime factor in livestock grazing management.

Current Conditions

In the late 1940s and early 1950s the Forest Service began the largest vegetation and soil monitoring program ever mounted by an agency—the Parker Three-Step Rangeland Condition and Trend Monitoring program. Despite limitations of the Parker transect data, SNEP recognized that much valuable interpretation was possible from this large database of information. The SNEP assessment used several contemporary functional response indicators to evaluate the historic data for sagebrush-steppe uplands and mountain meadow riparian areas on ten national forests (see volume III, chapter 24, for the precise methods used for this assessment). Indicators included:

- A decrease in the ratio of sedge-to-grass without compensation by rush species, indicating loss or declines in water tables either from stream downcutting or from enhanced runoff due to compaction.

- Invasion of weedy forbs, indicating excess soil water supplies due to loss of keystone perennial grasses.
- Reductions in abundance of late seral grasses due to inadequate recovery times following repeated grazing events.
- Radical fluctuations of clover species in meadows due to excited nitrogen cycling and close grazing of taller vegetation that formerly buffered against such wide swings in botanical composition.
- A “red-flag” indicator of more than 7%–10% bare soil in wet meadows, indicating severe abuse beyond what burrowing rodents could account for.
- Native versus non-native species composition trends.

A major section of the SNEP rangeland assessment is a compendium of individual plant indicators of livestock grazing effects that serve as short-term indicators of changes in community composition.

Sagebrush-Steppe

From GIS interpretations of data developed by the gap analysis portion of the SNEP study, it was determined that 45% of Sierra Nevada sagebrush-steppe rangeland is managed by the Forest Service, 31% by the Bureau of Land Management, and 23% by private owners. SNEP evaluated only those lands represented by the Forest Service and accompanying Parker transect data. Seven attributes were analyzed from the Parker transect data for seven of the ten national forests with significant acreage of sagebrush-steppe, including big sagebrush composition, native perennial grass composition, forb composition, non-native species composition, litter cover, bare soil exposure, and erosion pavement (tables 7.1, 7.2, and 7.3).

From the mid-1950s to the present, big sagebrush cover declined on all seven forests; however, native perennial grass composition increased by at least one-third on the Modoc, Lassen, Toiyabe, and Inyo National Forests. Trends for native

TABLE 7.1

Percentage of big sagebrush, native perennial grass, and forb composition in sagebrush-steppe communities on seven national forests over five decades. (From volume III, chapter 22.)

	Decade				
National Forest	**Before 1956**	**1956–65**	**1966–75**	**1976–85**	**1986–95**
Modoc	(9)[a]	(3)	(0)	(1)	(11)
Big sagebrush	15.4	22.0	—	15.0	14.8
Perennial grasses	7.3	3.0	—	6.0	10.5
Forbs	21.7	24.3	—	27.0	18.2
Lassen	(0)	(12)	(2)	(0)	(8)
Big sagebrush	—	12.8	17.0	—	11.2
Perennial grasses	—	6.5	6.5	—	8.4
Forbs	—	19.8	20.0	—	22.1
Plumas	(0)	(11)	(3)	(3)	(3)
Big sagebrush	—	23.7	9.7	17.7	30.0
Perennial grasses	—	2.9	5.0	5.3	3.0
Forbs	—	35.0	19.7	22.3	38.0
Tahoe	(3)	(5)	(11)	(3)	(0)
Big sagebrush	1.7	20.8	14.3	16.7	—
Perennial grasses	1.7	2.8	3.0	1.7	—
Forbs	8.7	29.6	21.7	19.3	—
Stanislaus	(0)	(0)	(7)	(5)	(0)
Big sagebrush	—	—	31.7	19.0	—
Perennial grasses	—	—	7.1	4.2	—
Forbs	—	—	41.7	25.6	—
Toiyabe	(0)	(10)	(2)	(10)	(2)
Big sagebrush	—	24.4	32.0	20.4	21.0
Perennial grasses	—	2.8	2.0	5.2	0.5
Forbs	—	29.3	25.3	28.1	43.0
Inyo	(0)	(8)	(2)	(0)	(10)
Big sagebrush	—	16.9	14.0	—	13.4
Perennial grasses	—	0.4	0	—	3.3
Forbs	—	24.8	25.5	—	23.7
Weighted Average	(12)	(49)	(27)	(22)	(34)
Big sagebrush	12.0	19.7	19.8	19.0	15.2
Perennial grasses	5.9	3.3	4.2	4.5	6.6
Forbs	18.4	27.2	27.1	25.5	23.9

[a]Numbers in parentheses indicate the number of transects.

TABLE 7.2

Percentage of non-native species composition in sagebrush-steppe communities on seven national forests over five decades. (From volume III, chapter 22.)

National Forest	Before 1956	1956–65	1966–75	1976–85	1986–95
Modoc	(9)[a]	(3)	(0)	(1)	(11)
Cheatgrass	0.8	3.7	—	0	2.5
Medusahead	0	0	—	0	0.6
Filaree	0.1	0	—	0	0
Dandelion	0.1	0	—	0	0
Lassen	(0)	(12)	(2)	(0)	(8)
Cheatgrass	—	0	2.0	—	0.1
Filaree	—	0.4	0	—	0
Plumas	(0)	(11)	(3)	(3)	(3)
Cheatgrass	—	0	2.0	0	0.1
Filaree	—	0.6	0	0	0
Wheatgrass	—	0	0	9.0	0
Tahoe	(3)	(5)	(11)	(3)	(0)
Cheatgrass	2.3	0.2	5.5	0.3	—
Wheatgrass	0	0	0.3	0	—
Plantain	1.3	0	0	0	—
Stanislaus	(0)	(0)	(7)	(5)	(0)
Filaree	—	—	0.4	0	—
Toiyabe	(0)	(10)	(2)	(10)	(2)
Bull thistle	—	0	0	0.2	0
Inyo	(0)	(8)	(2)	(10)	(2)
Cheatgrass	—	0.9	0.5	0	4.8

(Decade spans the columns Before 1956 through 1986–95.)

[a]Numbers in parentheses indicate the number of transects.

perennial grasses on the other three forests appear to be static or downward. Overall forb composition has been remarkably stable, with a tendency for a small downward decline in abundance on most national forests.

Cheatgrass was the most common non-native component of the monitored sagebrush-steppe. Overall, weeds other than cheatgrass were not detected as a major problem.

Based on historical review of livestock grazing on what is now national forest land, the Modoc National Forest was the most disturbed in the sagebrush-steppe, and the Lassen, Inyo, and Toiyabe National Forests were not far behind. Although the Modoc and other forests are showing declines in sagebrush and increases in cheatgrass, the increase in native perennial grass on four of the forests is a positive finding of improving ecosystem biodiversity. The general reduction in sagebrush cover is ecologically desirable as long as it remains as a major component of the sagebrush-steppe. Excessive prescribed burning of sagebrush-steppe would likely result in additional spreading of cheatgrass; however, some reduction in sagebrush would free up water resources for maintenance of a larger composition of grasses (including perennials). The slowly declining forb composition is likely to contribute to poorer diets for ground-nesting birds in the future. The high and increasing cheatgrass component on many of the forests is alarming, especially as California becomes more populated and even remote areas have greater probability of fire ignitions. In addition to contributing little value to biodiversity, cheatgrass is unpalatable to livestock, except for a short period during spring growth, and therefore accumulates as fuel that threatens the survival of other plant species in the event of fire.

Substantial reductions in livestock grazing intensity occurred during the five decades covered by this assessment; however, most ranges were stocked above carrying capacity as recently as the last one or two decades. The key positive indicator observed from the Parker transect data was the increase in native perennial grass composition on some of these upland rangelands. Thus, with continued improvement in management, there is reason to hope for reestablishment of more native grassland communities. The key negative indicator was the continued cheatgrass invasion. Use of livestock as a management tool to reduce cheatgrass appears to be limited.

Mountain Meadows

Transect data on mountain meadows for ten national forests of the Sierra Nevada and Modoc Plateau were analyzed for plant community composition attributes including grass, legumes, sedge, and rush species, non-native species, and exposed bare soil. The first set of indices used to indicate

TABLE 7.3

Percentage of litter, bare soil, and erosion pavement in sagebrush-steppe communities on seven national forests over five decades from transect data. (From volume III, chapter 22.)

National Forest	Decade				
	Before 1956	1956–65	1966–75	1976–85	1986–95
Modoc	(9)[a]	(3)	(0)	(1)	(11)
Litter	29.6	20.3	—	28.0	40.1
Bare soil	33.3	41.7	—	27.0	20.3
Erosion pavement	1.6	0.7	—	4.0	3.3
Lassen	(0)	(12)	(2)	(0)	(8)
Litter	—	24.4	16.0	—	38.9
Bare soil	—	18.2	2.0	—	9.6
Erosion pavement	—	12.3	0	—	10.5
Plumas	(0)	(11)	(3)	(3)	(3)
Litter	—	34.5	36.3	38.7	34.0
Bare soil	—	14.5	17.3	18.0	17.0
Erosion pavement	—	10.5	23.0	0	2.7
Tahoe	(3)	(5)	(11)	(3)	(0)
Litter	36.3	33.0	36.9	44.0	—
Bare soil	47.0	25.4	23.9	29.3	—
Erosion pavement	3.7	8.4	5.4	5.7	—
Stanislaus	(0)	(0)	(7)	(5)	(0)
Litter	—	—	16.1	14.2	—
Bare soil	—	—	9.0	19.4	—
Erosion pavement	—	—	24.7	34.4	—
Toiyabe	(0)	(10)	(2)	(10)	(2)
Litter	—	35.3	21.5	30.2	23.5
Bare soil	—	18.5	20.0	24.8	10.5
Erosion pavement	—	8.5	18.5	6.4	19.0
Inyo	(0)	(8)	(2)	(0)	(10)
Litter	—	19.9	29.5	—	23.5
Bare soil	—	19.2	23.5	—	26.5
Erosion pavement	—	32.9	20.5	—	17.4
Weighted Average	(12)	(49)	(27)	(22)	(34)
Litter	31.3	28.8	28.2	29.5	33.4
Bare soil	36.7	19.8	17.4	23.4	18.7
Erosion pavement	2.1	13.4	14.0	11.7	10.0

[a]Numbers in parentheses indicate the number of transects.

meadow functionality was grass, legume, sedge, and rush relative composition and trends. Wet and mesic meadow ecosystems, if overgrazed, show a trend of grass and legume composition increase at the expense of sedge and rush composition. Such trends usually result from soil compaction and stream downcutting; ultimately the result is drier site conditions, change in species composition, and lowered productivity. The opposite trend, however, typically indicates restoration of a water table, reduced runoff and increased infiltration, and gully repair. Given that livestock numbers have been reduced and many grazing systems and restoration projects have occurred during the five-decade monitoring period, we should expect some reversal of dewatering indicators, such as increases in moisture-loving sedges and rushes (grasslike plants). Two national forests, Modoc and Toiyabe, showed an apparent unfavorable meadow water-regime response: a reduction in sedges and an increase in grasses as an aggregate (table 7.4).

In mountain meadows on ten national forests, exposed bare soil has stabilized at around 5%, whereas before 1956 the average for all forests was about 11% (range, 1.5%–23%). Trends toward greater plant cover are most apparent on the Modoc, Lassen, Tahoe, Stanislaus, Sierra, and Sequoia National Forests.

Hardwood Rangelands

There are 4.7 million acres of hardwood rangelands (also known as oak woodlands) in the Sierra Nevada region. Data compiled by the California Integrated Hardwood Range Management Program (IHRMP) were used for SNEP's assessment of these significant areas.

These lands are concentrated in the western foothills (85% on private land) in a belt 20–30 miles wide from 450 to 4,500 feet in elevation. Nearly 800,000 acres of hardwood rangelands habitat in the Sierra Nevada were converted to other land uses and vegetation types over the last forty years, an

TABLE 7.4

Percentage of grass, legume, sedge, and rush species[a] composition in wet and mesic meadows on ten national forests over five decades from transect data. (From volume III, chapter 22.)

	Decade				
National Forest	Before 1956	1956–65	1966–75	1976–85	1986–95
Modoc	(2)[b]	(9)	(9)	(0)	(0)
Grasses	7.5	10.6	26.1	—	25.0
Legumes	5.0	7.0	10.3	—	9.0
Sedges	14.5	16.3	17.2	—	7.7
Rushes	4.5	5.0	6.1	—	2.5
Lassen	(0)	(13)	(13)	(1)	(15)
Grasses	—	22.6	19.9	31.0	29.4
Legumes	—	2.8	4.8	1.0	7.2
Sedges	—	20.4	22.0	26.0	19.6
Rushes	—	12.5	9.2	4.0	10.2
Plumas	(0)	(14)	(13)	(5)	(13)
Grasses	—	25.1	18.4	14.0	20.5
Legumes	—	6.6	3.4	4.0	13.0
Sedges	—	20.6	21.1	22.8	23.2
Rushes	—	13.1	16.1	9.6	11.1
Tahoe	(1)	(16)	(12)	(11)	(7)
Grasses	13.0	32.9	31.9	28.6	20.3
Legumes	0	10.1	4.8	3.9	15.0
Sedges	25.0	18.6	22.2	22.3	24.4
Rushes	19.0	2.9	11.8	10.1	11.0
Eldorado	(5)	(12)	(13)	(0)	(3)
Grasses	24.4	22.6	46.7	—	16.7
Legumes	4.6	6.0	8.0	—	4.0
Sedges	20.6	13.1	12.9	—	1.0
Rushes	0.4	9.1	12.2	—	0
Stanislaus	(1)	(8)	(14)	(10)	(2)
Grasses	10.0	27.4	20.3	19.1	7.5
Legumes	0	18.0	6.4	11.0	2.0
Sedges	2.0	28.8	35.6	31.7	30.5
Rushes	0	0.6	1.9	0.8	3.5
Sierra	(6)	(13)	(15)	(0)	(4)
Grasses	29.2	19.3	18.6	—	6.2
Legumes	10.3	3.6	4.3	—	4.5
Sedges	19.7	40.8	34.3	—	47.0
Rushes	1.7	4.6	6.1	—	9.0
Sequoia	(0)	(10)	(8)	(4)	(0)
Grasses	—	12.5	8.5	11.8	—
Legumes	—	8.0	8.8	8.0	—
Sedges	—	41.9	50.4	41.2	—
Rushes	—	10.8	6.1	6.2	—
Toiyabe	(0)	(10)	(1)	(10)	(0)
Grasses	—	16.3	17.0	24.8	—
Legumes	—	6.7	0	8.7	—
Sedges	—	26.4	44.0	22.4	—
Rushes	—	6.2	14.0	7.4	—
Inyo	(0)	(20)	(3)	(15)	(11)
Grasses	—	12.5	13.0	9.6	18.0
Legumes	—	6.9	5.0	10.2	2.5
Sedges	—	37.8	25.5	53.8	35.3
Rushes	—	8.6	33.5	3.4	8.1

[a]Grasses (Poaceae), legumes (Fabaceae, primarily *Trifolium* spp.), sedges (Cyperaceae; primarily *Carex*, *Scirpus*, and *Eleocharis*), and rushes (Juncaceae, primarily *Juncus*).
[b]Numbers in parentheses indicate the number of transects.

overall decline of almost 16% and highlighted by individual county losses as high as 42% (table 7.5). Major conversions from 1945 through 1973 were from rangeland clearing for enhancement of forage production. Since 1973, major losses have been from conversions to residential and industrial developments.

Introductions of domestic livestock and exotic annuals have led to dramatic changes in hardwood rangeland ecosystems.

TABLE 7.5

Changes in hardwood habitat in the Sierra Nevada region from 1945 to 1985. (From volume III, chapter 15.)

County	Percentage Change
Shasta	+7
Tehama	–23
Butte	–9
Yuba	–18
Nevada	–18
Placer	–32
El Dorado	+2
Amador	–28
Calaveras	–29
Tuolumne	–42
Mariposa	–21
Madera	–13
Fresno	–19
Tulare	–2
Kern	–15
Sierra total	–16

The herbaceous layer has changed from a perennial layer to an annual layer. Fire intervals have increased dramatically, and fire intensity has also increased. The overstory tree layer, if not converted to another land use, has generally increased. Soil moisture late in the growing season has decreased, and soil bulk density has increased due to compaction from higher herbivore densities. Riparian zones are now lower in vegetation density and diversity.

These major impacts of livestock grazing also suggest other ecosystem influences:

- More moisture may be available to oaks when the herbaceous layer is removed by grazing.
- Transpirational surface area of seedlings, reduced by grazing, may result in higher soil moisture later in the summer.
- Consumption of ladder fuels reduces the likelihood of crown fires in grazed woodlands.
- Grazing animals consume oak seedlings and acorns, thereby reducing their availability as food for rodents and other wildlife.
- Grazing may increase soil compaction, making root growth for developing oak seedlings more difficult.
- Less organic matter may be available for incorporation in soils.

Research on the effects of removing oak trees, particularly relative to forage production, has provided a number of general findings:

- There is little or no enhancement of forage value from removing blue oaks in areas with less than 20 inches of annual precipitation.
- For areas with greater than 20 inches of annual precipitation, thinning oaks where the canopy exceeds 50% will increase forage production.
- In areas thinned for forage enhancement, residual tree canopies of 25%–35% are able to maintain soil fertility, provide wildlife habitat, and minimize erosion processes.

Ironically, factors that cause livestock operations in hardwood rangelands to suffer low profitability and high risk are leading indirectly to conversion of these lands from extensively managed private ranches to suburban developments:

- Dramatic annual fluctuations in livestock markets.
- High variability in annual rainfall, leading to unpredictable forage shortages.
- Higher profitability potential from suburban development or intensive agriculture industries such as wine grapes.
- Uncertainties about federal grazing policies for public rangelands required for summer pasture.

At the individual stand or patch level, oak woodlands actually appear to be much more stable than previously thought. Concerns about oak regeneration are not well founded. Long-term trends reveal stand structures with recruitment into various size classes and increasing canopy density under typical livestock management practices. Technologies have been developed to carry out restoration of areas denuded of oaks in the past. Voluntary research and education programs such as the IHRMP have made dramatic, measured progress in accomplishing sustainable management practices by landowners. The major accomplishments have been made in the more rural areas of the state where livestock and natural resource management are predominant land uses. Where individual landowners have the ability to implement management activities that affect large acreages, education and research have contributed to decisions that favor conservation of hardwood rangelands.

Potential for Recovery and Sustainable Range Management

Patterns of increasing cheatgrass and other exotic plant invasion in sagebrush-steppe communities and associated increases in fire frequency due to increases in flashy fuels threaten to spread this condition throughout this community type. Extensive overgrazing of most Sierra Nevada and Modoc Plateau meadows, upland shrublands, and stream / riparian systems before 1920, followed by documented substantial reductions in domestic livestock numbers through the 1960s, still presents managers with many damaged meadow / riparian and upland rangeland conditions in need of restoration. Many meadows have downcut stream courses, compacted soils, altered plant community compositions, and diminished wildlife and aquatic habitats. Many uplands have excessive bare soil exposure dependent on annual grasses for their future stability.

The mechanisms involved with invasion by annual grasses defy the natural restoration capacity of Sierra Nevada upland rangelands. Even intense application of active management techniques will have uncertain success in restoring native plant communities. If grazing were completely eliminated from these ranges, the restoration task would be no less monumental.

In spite of persistent problems, the remarkably recovered condition of many ecosystem components of montane meadows and uplands today indicates that well-watered meadow / riparian ecosystems have tremendous potential for restoration of plant communities, while providing very important agricultural grazing values to society. Beginning about 1975 and continuing to today, land management agencies and ranchers have conducted numerous riparian restoration demonstration projects throughout the Sierra Nevada and Modoc Plateau. Public rangeland managers, allotment by allotment, have prioritized limited funding and gained cooperative support of permittees to target riparian restoration management on local problems within allotments. Though livestock exclusion from riparian pastures has been the common method, many other grazing management strategies, such as increased animal distribution control measures, sometimes with reductions in numbers of livestock, have resulted in favorable improvements. In some cases, grazing systems that variably adjust intensity and duration have resulted in increases in livestock carrying capacity while reducing environmental impacts.

Continuing efforts to reduce local undesirable grazing impacts to soils, streams, and habitats could return natural aquatic and terrestrial functionality where it is currently at less than its potential. Better management can increase not only native biodiversity, wildlife habitat, and nonforage values but also livestock performance. Forage plant vigor has as much to gain as riparian functionality.

The area of closely grazed rangeland and the length of damaged riparian / stream habitat is substantially higher than under presettlement conditions. The ecological function and agricultural productivity of Sierra Nevada and Modoc Plateau rangelands are depressed below their potential. Rangelands provide a wealth of habitat and aesthetic values to the general society, and grazing values to an important agricultural industry, but management directed to improve ecological functionality and agricultural productivity has not been realized to the extent possible.

Livestock grazing in a mountain meadow. Headwaters of Willow Creek near Eagle Lake, Lassen County. (Photo by Michael Oliver.)

A GRAZING AND RANGELAND STRATEGY

Goals

There are three goals for the grazing and rangeland strategy:

1. Improve soil and stream-bank stability and aquatic / terrestrial habitats on mountain meadows, upland shrublands, and stream / riparian ecosystems.
2. Prioritize restoration on meadow / riparian systems that are in an upward trend in functionality and on upland shrublands that show resistance to weed invasion and greater abundance of native perennial grasses.
3. Continue adherence to the mission of the California Integrated Hardwood Range Management Program (IHRMP): "To maintain, and where possible expand, the acreage of California's hardwood range resource to provide wildlife habitat, recreational opportunities, wood and livestock products, high quality water supply, and aesthetic value."

Possible Solutions

Operationally, the key management element is to ensure that the persons responsible for livestock management are knowledgeable about undesirable impacts and are dedicated to improving conditions. Training will need to be a large part of carrying out this strategy. Frequent monitoring of livestock impacts and rapid solutions are required.

Clearly articulated descriptions of what meadow, riparian, and upland conditions are desired, in proximate and ultimate terms, must be developed. That is, without expecting or proposing the impossible, it must be made clear in ecological and managerial terms the stages (state and transition seral stages and timing) each system can and should go through to achieve two goals concomitantly—increased ecosystem functionality and increased agricultural productivity.

The rancher / permittee and agency manager would take joint responsibility for understanding and seeking the proximate and ultimate rangeland conditions described. Operationally this task is a large one. Each party would become educated about rangeland ecosystem responses to management and other natural environmental forces, develop tolerance for practical versus technical understanding of ecological and agricultural aspects of range systems, and overcome tensions arising from diverse viewpoints about individual priorities.

Prescriptive and adaptive management could be implemented with an accountable system of ten-year allotment and annual operating plans supported by professional rapport among the rancher / permittee, the agency range manager, and the public at large. At the outset of this strategy, goal 1 seeks to reduce local forage overutilization and associated soil and stream-bank instability and undesirable aquatic / terrestrial habitat impacts on grazing allotments. Overutilization of forage is a temporal event never referencing longer than one growing season's production; however, it can occur in as short a time as a few days. What goal 1 focuses on is animal distribution control, using such means as herding, salting, fencing, water development to attract animals, and culling of individual unmanageable animals.

Currently, thirteen of fifteen Sierra Nevada counties have adopted or started the process of adopting local hardwood rangeland conservation strategies. Most have adopted voluntary guidelines, which should be continually monitored to measure their efficacy. Optionally, conservation strategies can be incorporated in ordinances or can become part of county general plan policies that govern land use.

Implications

As range managers have become more aware of short- and long-term undesirable impacts of grazing livestock on multiple-use public rangelands, animal management has become more complex, time-consuming, and expensive. Because rangelands are often remote, problem situations that could be easily managed too often go unnoticed for weeks, months, seasons, and sometimes even years.

The rancher may not perceive that problems even exist. What is recognized as a problem changes as understanding and standards change. Ranchers and agency managers would need to be in much closer touch with the resource and each other than they have been in the past.

On some allotments, herder / riders may need to be present much of the time to avoid undesirable impacts; this represents an additional cost to the rancher. One major potential trade-off for this additional management cost for the rancher is the proven increase in productivity possible with time-controlled grazing. Intensive grazing systems pay great dividends in forage productivity enhancement when plants are grazed heavily for a very few days and then have as much as a month to regrow before being grazed again. Such controlled grazing systems should offset some of the added cost of herding.

Using a suite of ecosystem functionality and livestock carrying capacity and performance criteria, trends in many redundant measures will corroborate whether management has been successful. Many of the criteria will be site-specific, but the conditions measured in the SNEP rangeland assessment, including bare soil exposure, width / depth ratios in meadow streams, and abundance of native perennial grasses and weeds, as well as fish and aquatic organism diversity and neotropical bird nesting success should be used. Monitoring (data compilation and analysis) of key associated ecosystem factors needs to be an integral part of this management strategy. The task of reading condition and trend transects is not unreasonable, but it must be done on at least a three-year schedule. Annual monitoring of other short-term indicators will also be a necessary part of the annual operating plan for the ranchers and range managers.

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